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On Learning to Talk: Are Principles Derived from the Learning Laboratory Applicable?

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While studies in learning and verbal behavior show that learning comes through paired-associate problems, they do not explain the acquisition of language. Three paradigms demonstrate mediation effect in paired-associate learning: response equivalence, stimulus equivalence, and chaining model. By reviewing children's language acquisition patterns in terms of the three paradigms, several conclusions were reached. A child utters words which are related to his experience. He establishes response and stimulus equivalence paradigms simultaneously. In a response equivalence situation, he learns one response can apply to several stimuli, and in a stimulus equivalence situation, one stimulus is paired with many responses. When learning complex utterances, the child chains equivalence paradigms. The same patterns are applied in learning plurals, tenses, and negatives. In an addendum, the author discusses the positions of a psychologist and a linguist in language acquisition. The psychologist ignores the complexities of the language, oversimplifies imitation, and disregards the relationship between memorizing and meaningful learning. The linguist assumes hierarchical learning but does not test it, and he rejects mediation learning theories. Although maintaining separate goals, the two schools should act jointly to stimulate needed further research in language acquisition. (JS)

ON LEARNING TO TALK:
ARE PRINCIPLES DERIVED FROM THE LEARNING LABORATORY APPLICABLE?

David S. Palermo
The Pennsylvania State University

RESEARCH BULLETIN NO. 61
February, 1966

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to
The Pennsylvania State University

Department of Psychology
The Pennsylvania State University
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On Learning to Talk

Are Principles Derived from the Learning Laboratory Applicable?[1]

David S. Palermo[2]

The Pennsylvania State University

Let me begin by confessing that I feel a little bit like the monk in the monastery attempting to determine the number of teeth in the mouth of a horse without ever having seen a horse. While the research in which I have been engaged for the past several years has involved the study of children dealing with problems involving words, none of the work which I have been doing would be considered a study of language acquisition. As a matter of fact, all of the research which I have published has involved children who have long since acquired the basic grammar of the language and only recently have I begun to work with children below the fourth grade. Thus, the things which I have to say will be based, for the most part, upon principles which have more or less substantial evidence from laboratory work which, it is assumed, may have some relevance to the topic at hand while never

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directly tested in connection with that problem. I am highly likely to behave as the child and overgeneralize where it is inappropriate but, as in the case of the child, I expect that additional data will quickly correct me.

I take comfort from two facts: first, I was invited to make this fanciful theoretical flight by those who have studied language acquisition per se and second, the data are meager. In fact, ten years ago a symposium such as this would have been ridiculous for the monumental efforts of collecting language acquisition data from very young children by our discussant, Susan Ervin-Tripp and her colleagues (Miller & Ervin, 1964), Brown and his colleagues (Brown & Fraser, 1964) and Braine (1963) were not available until very recently. Furthermore, the linguistic theory advanced by Chomsky (1957), which has acted as an accelerating catalyst to the work in this area, was equally unavailable. The systematic data collection efforts of these persons has advanced us a long way, but it is clear that we must move ahead with caution when we consider that we have extensive data on but a handful of children most of whom come from relatively rich linguistic environments. It is trite but true that we have progressed considerably from the antecdotal data to which we were limited less than ten years ago, but we have a great deal to do before we can have much confidence in statements which we make about language acquisition.

Nevertheless, it is apparent that the data in hand show some remarkable regularities across children. Dr. Slobin (1965), in the previous paper, has pointed out but a few of these regularities. There is no one who would argue that there is no system to the language which we use, although most of us can not verbalize many aspects of

the symstem, but I am sure that most persons are surprised at the regularities which have been found in the initial efforts of the child to acquire the system regularly presented to him by the various sources of language input available to him. It is certainly true that all of the utterances of the child do not show discoverable regularities, but the fact that large portions of the language of a small group of children can be shown to follow similar patterns is a finding of considerable importance and demands some theoretical accounting.

Before attempting to advance some theoretical guesses, and they can be no more than guesses for that is as close as we can get to explaining descriptive data without any experimental manipulation of of the variables considered important, I would like to take a few moments to present some background relevant to the hypotheses which I want to apply to the data which have been presented.

While the study of language acquisition, or learning, has a pitifully short scientific history, the laboratory study of verbal learning and verbal behavior has been productive over a considerably longer period of time. It seems to me that some of the experimental findings derived from this work, while far from providing a comprehensive account of language acquisition, may have a bearing upon, and provide some clues to, the understanding of how a child learns to talk.

The major efforts of those working in this area have been devoted to the examination of variables which influence paired-associate learning. While the study of serial learning and other verbal learning problems devised to examine specific phenomena have been employed, much of what we can say about verbal learning comes from the paired-

associates problem. In this learning problem, the subject is faced with the task of associating a set of stimulus-response pairs generally composed of word, or word-like items. He is presented, one at a time, with a series of verbal stimuli arranged in a number of random orders, to each of which he is to learn to give verbal responses arbitrarily paired by the experimenter with the stimuli. In most cases, the subject has had no previous experience with the items as pairs. Thus, paired-associate learning, by the contiguous presentation of stimulus and response, involves the establishment of associative relationships between two previously unassociated items such that the functional aspects of the stimuli come to call out, elicit or lead to the responses paired with them. Characteristically the subject learns the list over a series of trials without making many overt errors, i.e., the subject tends not to respond at all until he is at a point of being reasonably sure that when he makes an overt response it will be the correct one.

It is clear from several studies (e.g., Underwood, 1963; Jenkins, 1963; Jenkins & Bailey, 1964) that it is necessary to point out that the associative relationship acquired is between the fuctional stimulus and the response. The subject does not necessarily use the stimulus that the experimenter presents, at least not all of it. This, of course, relates to an old problem for psychologists concerning the definition of the stimulus (Spence, 1956). In any case, it is the most salient or meaningful characteristics of the environmentally presented, or potential, stimulus which will be the functional, or effective, stimulus for the subject, if those characteristics will allow learning. Thus, the subject selects from his environment

specific stimuli to which he responds. The less salient or meaningful the stimuli for the subject, the more difficulty he is likely to have in learning the associations required.

Turning to the response side of the paired-associate task, we find that, here too, performance is affected by the characteristics of the material presented to the subject. The rate of acquisition is clearly a function of the amount of past experience with, or meaningfulness of the responses (e.g., Noble, Stockwell & Pryer, 1957; Palermo, Flamer, & Jenkins, 1964). In fact, the data would suggest that response meaningfulness is more potent in terms of its influence upon rate of learning than stimulus meaningfulness (Mandler & Campbell, 1957). It should be pointed out, in addition, that Underwood and Schulz (1960) have suggested, and the data seem to bear them out, that there are two phases in the learning process: a response learning phase and an associative phase. The subject must first discover the pool of items to be acquired and be able to recall these items, and then he can proceed to the task of associating a particular response with a particular stimulus. Furthermore, it should be noted that there is considerable evidence to support the contention that when a subject is required to learn to make a response to a stimulus, he is learning, at the same time, what the stimulus is for that response, i.e., the establishment of the traditional S-R associative connection involves learning an R-S connection as well (Murdock, 1956; Palermo, 1961).

The study of paired-associate learning, however, is not limited to single list learning and the studies of multiple list learning in which associative relationships are established among multiple stimuli and responses across lists are of greater relevance to this discussion

(Jenkins & Palermo, 1964). I am referring to the relatively recent, and rapidly expanding, literature dealing with mediation phenomena. Three basic paradigms have been used to demonstrate the mediation effect within the paired-associate situation.

The first paradigm has been referred to as the chaining model. The subject is required to learn a series of lists of paired words in which each successive list has as its stimuli the responses of the previous list and the final list, which is the test for mediation, is composed of the stimuli of the first list and the responses of the last preceeding list. Thus, in the three stage paradigm, the subject learns A-B followed by B-C and mediation is tested on the last list composed of A-C pairs. It is assumed that learning of the A-C pairs in the final list is influenced by the mediating B term which links the A and C terms as a function of learning the previous lists. Thus, the subject learning A-C has acquired a sequential chain of associations from A to B to C. For example, if the subject first learns to respond to the word "other" with the word "man" in List 1 and then learns to respond to the word "man" with the word "car" in List 2, he should have no difficulty in responding to the word "other" with the word "car" in List 3. It will be noted that the words "other" and "car" in this example have never occurred together but, as a function of the implicit or explicit occurrence of the mediating word "man", there is a chain of associations forming a sequence "other", "man", "car".

The second type of design has been referred to as the response equivalence paradigm. In this case, the subject may be required to learn several different responses to the same stimulus and, as a

result, these responses come to have equivalence in the sense that presenting one as a stimulus will tend to elicit the others as responses. Thus, in the three stage paradigm, the subject learns B-A followed by B-C and then mediation is tested in an A-C list. Again it is assumed that learning the A-C pairs in the final list is influenced by the mediating B term which is associated with both the A and C terms as a function of previous list learning. An example of this paradigm might include the learning of "big" - "boy", followed by learning "big" - "boat" with an expectation that in a third list "boy" and "boat" would be easily associated because, as a function of having learned "big" - "boy" in List 1, "boy" occurs as an implicit response to "big" in List 2 forming a chain from "big" to "boy" to the new response in List 2, "boat". As a function of this chain, established in List 2, the subject has no trouble acquiring something he has already learned despite the fact that "boy" and "boat" have never before explicitly occurred together in the experiment.

Finally, the third type of design is known as the stimulus equivalence paradigm. Here the subject may be required to learn the same response to several different stimuli, i.e., it is quite similar to the response equivalence design except the equivalence is developed on the stimulus side. The stimuli come to have equivalence in the sense that presenting one as a stimulus will tend to elicit the others as responses. In the three stage paradigm, the subject may learn A-B followed by C-B and, as in the previous paradigms, he is tested for mediation on an A-C list. Once again, it is assumed that the B term acts as a mediator. In this case, the occurrence of

mediation requires R-S as well as S-R associations during learning of the previous lists. When the A term is presented in the third list it is assumed to lead to the overt or convert occurrence of B as a function of first list learning and the B term will elicit the correct C term because during List 2 learning, backward as well as forward associations were established.

All of these three stage paradigms have received strong experimental support both with adults and with grade school children (e.g., Horton & Kjeldergaard, 1961; Nikkel & Palermo, 1965). Some of the results with children are more impressive than those obtained with adults. In addition, there is evidence to support the mediation interpretation when larger numbers of associative links play a part prior to the mediation test (Russell & Storms, 1955; McGehee & Schulz, 1961). The materials used in these experiments have included words of high and low frequency, trigrams and combinations of these. In many cases the first link in a paradigm has been assumed from word association norms with equally impressive results. Finally, it is clear that the results are not limited to the usual paired-associates task but may be extended to such things as mediation of attitudes, for example (Eisman, 1955).

While the chaining paradigm involves the sequential linking of items, the stimulus and response equivalence paradigms involve a kind of stimulus and response concept formation. In the chaining case, the responses of the first list become associated with the stimuli of that list and are then used as stimuli for a subsequent set of responses which, in turn, may be used as a stimuli for other responses and so on. Breaking into any part of the sequence should allow

associations to run off from that point to the end of the chain although the evidence for R-S as well as S-R learning would suggest that associations in either direction might occur. In the case of the stimulus and response equivalence paradigms, however, classes, or conceptual groupings, of stimuli and responses may be developed as a function of the fact that members of the classes have the same privileges of occurrence during acquisition, i.e., in the response equivalence paradigm, for example, a number of different responses become associatively related in a conceptual class because they are all made in the presence of a particular stimulus or set of stimulus conditions. While little is known about the manner in which the subject is able to identify classes of stimuli and responses in such paired-associate tasks, it is clear that some sort of selector mechanism, as Underwood and Schulz (1960, p. 143 ff.) have called it, does operate to delimit the groups of items acquired in such a way that they are not confused with other responses or classes of responses.

In summary then, if we assume that language acquisition is not basically different from any other acquisition task faced by the human organism, and I would be willing to make that assumption at this point, these laboratory derived data would suggest that we need to consider a variety of variables when we look at what may be influencing the behavior exhibited by the child as he approaches the performance criterion of adult language patterns. We shall certainly wish to examine the characteristics of the stimulus situation, both in terms of contextual cues and linguistic cues, in order to determine the relationships between the functional stimuli among the many potential stimuli available, and the language or verbal behavior observed. We

will be interested in the amount of exposure to aspects of the language as it relates to response integration and meaningfulness prior to the occurrence of overt responses which may or may not be judged as linguistically acceptable. We will wish to determine what are meaningful characteristics of the environmental situation from the child's point of view. We will want to know what the functional stimuli are. We shall be interested in the opportunities for, and evidence of sequential relationships and class or concept formations in the child's behavior since this appears to be a characteristic of language. If these were the only variables of importance it would be most surprising but these may give a start to the analysis and provide the impetus to experimental, as well as descriptive, research on child language acquisition.

Let's look now at the child's acquisition of language and see if these principles can account for any of the observations which have been made. We need, however, to make a few basic assumptions about the child. I will assume that the child is capable of learning relationships between stimuli and responses, i.e., that he can learn. Second, I assume that he can make conceptual generalizations when the stimuli or responses can be grouped on some sort of dimensional or mediational basis. Further, I assume that the generalizations, or concepts, can be subdivided in an hierarchical arrangement and, thus, continually refined. This latter assumption is one for which there are no experimental data of which I am aware, i.e., no one has taken the response equivalence paradigm, for example, and having established equivalence among a number of responses, subsequently arbitrarily divided them into subgroups such that some of the responses are

appropriate when the stimuli are presented in one context and others are appropriate when the stimuli are presented in another context. I certainly believe, however, that this is experimentally demonstrable and that the conditions under which varying amounts of interference would occur could be specified. It has been demonstrated, incidentally, that pigeons can learn to make one response to a colored key when the context includes lights on and a different response to that key when the context includes lights off. One final assumption about the child is that he is highly motivated to learn to use the language. Certainly he has far more motivation than the college sophomore working as a subject in the laboratory.

Now let me further assume that when the child does say something, as different as it may be from the adult language, it is accepted by, and frequently communicates to, the adult to whom it may be spoken. I believe that the acquisition of language may be much like the process which Skinner has called shaping, in the sense that initially the parent will accept any efforts the child makes and, as the child shows progress, the requirements for communication become more and more stringent. The motivated child wishes to communicate more precisely and the parent wishes him to do so. It is not a matter of the adult dropping pellets for each correct utterance, but is a matter of achieving a goal of mutual intelligibility. Clearly many of the linguistic exchanges between the parent and child require interpretations on both sides and these interpretations become less and less necessary, or dependent upon contextual cues, as the child approaches the criterion.

Now when the child acquires his first words he probably does so

as a function of simple conditioning or paired-associate learning. The parent places objects, including himself, before the child and labels them; he frequently indicates observable characteristics of those objects in adjective and verb forms; and he may even do such things as wave the child's hand and say "bye-bye". Thus, the single word utterances of the child tend to be content words such as "ball", "dolly", "mommy", "big", "go", "allgone", and so on. These are labels and descriptions of objects and events which have clearly observable correlates. Generally the child emits his first word at about the age of twelve months and for six months or so he uses only single word utterances as he torturously builds a small vocabulary. But the objects in the child's environment do things, objects he wants are not always available to him, and he does not always have success with one word in communicating these ideas to those about him. One word utterances are not enough!

Some of the single word utterances of the child may, however, occur under the same or similar, stimulus conditions. For example, conceive of the environmental conditions in which the child's ball is on a shelf in sight, but out of reach. The child may obtain the ball on the shelf by saying "want", and perhaps pointing, or he may obtain the ball by saying "ball". Sometimes he says "want" and sometimes he says "ball" and both utterances may bring about the desired result, i.e., both are correct responses for the same stimulus situation. We have then the simplest case of response equivalence and the occasion for the occurrence of "want" to elicit "ball" and, thus, the two word utterance is possible. But "want" may have been used interchangeably with "truck", and "dolly" and

"horsie" in which case we have a class of words which go with "want". We have a pivot word "want" and an open class of items which a child may want at one time or another. Thus, the pivot word - open class construction may come from the response equivalence paradigm. Once the open class equivalences are established, the child is capable of generating all kinds of new utterances which he has never heard. Similarly we can imagine the occurrence of many situations, or stimulus conditions, which elicit the same response. For example, when daddy leaves the house, he is "allgone", when the milk leaves the cup it is "allgone" and when the truck disappears under the bed, it is "allgone". A construction of the open class followed by the pivot word may be conceived as derived from the stimulus equivalence paradigm. Again, the child has productive language capabilities because of the equivalences established.

The less frequent open-open class two word construction may arise in much the same manner. The child may see two objects contiguously in the environment and respond by naming as in the two word utterances "man car" or "milk cup", for example. The contiguous occurrence of two objects in the environment would, thus, lead to the occurrence of two word utterances of the open-open class type. I suspect, however, that the pivot-open and open-pivot constructions of the child are the earliest two word utterances and that the open-open type of construction comes slightly later as a precursor of three and four word utterances. The open-open construction generally involves the omission of the pivot word necessary for communication. Thus, in the construction "man car" the pivot word "in" may be missing, and in the construction "car bridge" the pivot word "under" may be

missing if the interpretations assigned to these utterances are correct. The utterance is possible through chaining from open to pivot to open word classes. The difficulty with this interpretation is that for the chain to be established we must assume that the class of pivots act as the mediator rather than specific words since the pivot words tend to have fixed positions. If we assume that position of a word in an utterance is also a cue, or functional stimulus, then the chain from open class first position-pivot class second position to pivot class first position - open class second position allows a chain from open class to open class with the mediating pivotal word position omitted, but implied, in the utterance. Some of the utterances of Stephan in Braine's work suggest that the pivot is not completely dropped. Parts of what might be pivot words are uttered by Stephan but not in a way which is interpretable (Braine, 1963).

Before proceeding with an analysis of the three word utterance it must be remembered that the child is not developing all of these constructions independently. His parents provide him with a great variety of other linguistic utterances, in addition to the specific lessons about labels, which are correlated with events in the child's environment. Thus, there is a great deal of linguistic stimulation presented to the child (at least in the environment of the children on which we have data). Looking at it from the child's point of view, there may be a number of salient cues associated with the complex stimulus pattern presented. There are, for example, meaningful lexical items scattered throughout the stimulus pattern, some aspects of the pattern are stressed relative to other aspects, some of the

meaningful and stressed items tend to have positional patterns in the utterances, and many of the utterances are correlated with other environmental events. All of these characteristics, and undoubtedly more, surely play a part in determining what the functional stimuli for the child will be and, therefore, which stimuli will influence his linguistic behavior.

The three word utterance generally seems to take the form of pivot, open, open; open, pivot, open; or open, open, pivot. I think we can assume in each of these cases that initially the child is chaining together sets of words which occurred earlier as pairs of words and as single word utterances. Thus, the child may have uttered "other man" and "man car" which is the arrangement in the three stage chaining paradigm which would allow for the utterance of "other man car" with the mediator "man" overtly present in the utterance. This is a sentence of the type pivot, open, open, but there is no reason to assume that constructions of the type open, pivot, open or open, open pivot would not be constructed in a similar manner. Furthermore, there is no reason to assume that this is a construction with no depth. It may be assumed that the chain of two sets of two word constructions may be responded to as one pair construction super-imposed upon another. If the child could be induced to break the sentence, in the "other man car" example, into two parts, it would be predicted that he would break it into "other man" and "car" on the assumption that the pivot-open class construction is learned as a unit and "car" is either a single word utterance or comes from an open-open class construction which is assumed to be a three word utterance with the pivot word omitted. It is clear that

with such constructions and the open class equivalences, all kinds of new words may be inserted into the open class slots to construct new utterances never before heard. The child needs only three open class words and two pivot words to construct 36 three word utterances, none of which he may have heard as such, although a few of them may have been heard in an expanded version.

Now the child also adds other kinds of lexical items to his utterances. For the most part, the words he uses in his early constructions are labels specifically taught and descriptive words about those labels (adjectives and verbs). These are the stressed words in the adult language which he hears. There are, however, other aspects of the complex linguistic stimuli to which he is exposed and these, too, make a difference in communication, e.g., words such as "a" and "the", descriptive words such as "cowboy" in relation to hat, "blue" in connection with flower and so on. When these words do make a difference, and communication breaks down because they are not attended to, then these words are also stressed in speech. If I say to one of my children "You may have a piece of candy." and he takes a handful, I repeat the sentence putting a different stress on the words involved, "You may have a piece of candy." Assuming that these events occur, and we have little basis on which to judge, such experiences will call to the attention of the child the importance of the unstressed words as well as the stressed ones. Furthermore, attention to these items will lead to their appearance in utterances of the child and they will appear according to the rules the child develops through the associative consistencies with classes of words he has already developed. For example, the

child may have acquired a stimulus or response equivalence class of words we might label loosely as nouns which he has not as yet differentiated with respect to singular and plural or mass nouns and count nouns. He observes that his parents say "a car", "a toy" and "a dog" all of which are members of his class which we have called nouns. He, therefore, feels free, at this time, to substitute for "car", "toy" and "dog" other members of his noun class. Most of the time he will be correct and even when he says "a busses" or "a milk" I suspect that it is frequently accepted without correction and, on occasion, overtly rewarded because it sounds cute to the adult.

This kind of situation is not much different from the difficulty the child has with inflections of verbs for past tense and nouns for plural and possessive. We need only consider the case of the inflection of verbs for past tense since that is the case in which there is the peculiarity of the correct formation of the past tense of irregular verbs first, followed by incorrect generalization of the regular verb form inflection to the previously correctly formed irregular verbs. In the case of the strong verbs such as "come", "do" and "break", it is clear that these are learned early and I would assume that the past tense form is learned by simple rote. They are frequently used by adult and child making the possibilities for rote learning feasible. As the child acquires a vocabulary, however, a large number of different words of the verb form are acquired. Once the child attends to the tense markers, we have a stimulus equivalence paradigm arrangement in which the stimuli, the base forms of the verbs, acquire equivalence because the same inflection is used to form the past tense. (There may be other bases for

forming such equivalences, semantic ones for example.) Thus, experience with a few members of the regular verbs will lead to generalization of the inflection for all members of the class of which both strong and weak verbs form a part. Again, the fact that the generalization is incorrect part of the time does not seriously impair communication and, thus, is not quickly corrected.

How now does the child learn to negate some of the utterances he may wish to make? The word "no" comes into the child's vocabulary at a fairly early age. He may be taught a meaning of the word very early, long before he utters any words, through straightforward classical conditioning. My sample is small, although not small relative to the numbers of children we are considering here, but all four of our children learned when they were crawling that the word "no" emitted by their parents meant, "Stop what you are doing or about to do". It was taught by the simple method of presenting the conditioned stimulus "no", in the appropriate context, followed very quickly by a noxious unconditioned stimulus such as slap on the hand. Children can, and did, learn the meaning of the word quickly and, at later ages, often may be observed using it to direct their own actions as in the case of the child who walks around the bowl of candy on the coffee table saying to himself, "No, no". I am surprised that "no" is not more frequently a pivot word than appears to be the case in the protocols available.

The initial negatives the child learns may be rote learned as in the case of "no more"; or they may be a case of paired-associate learning of "no" plus one or more word affirmative utterances or affirmative utterance plus 'no" at the end; or it may be a case of

"no" being a pivot word with an open class of single or multiple word utterances which may occur before or after it. In the latter alternative, we may have a special case of the pivot-open or open-pivot class utterance in which the word denoting negative is a pivot and the affirmative or declarative type of utterance, regardless of the number of words, composes the open class.

Once the child begins to negate his sentences then both he and his parents may begin to attend to the stimuli which are functional to the communication of negative forms. The parent may have been trying to teach the child this form for some time before the child begins to be concerned with it. The child, for example, says "Candy" (with or without rising intonation) and the parent responds, "You can't have any candy until after supper." If the child then reaches for the candy, the parent is likely to say, "No, you can't have any candy." The parent has presented a stimulus-response pair, i.e. "no" plus sentence, for paired-associate learning or the parent has presented the "no" pivot plus open class frame. In addition, however, the parent has placed additional stress on part of the negative sentence to call the child's attention to the fact that "can" plus "'t", or "not" as the case may be, is important and makes this sentence different from the affirmative form. Since the child apparently does not use auxiliaries at this point, the child may be learning that the auxiliary with "'t", or "not", is the important aspect of creating a negative. He is not learning "can plus not" but rather, he is learning that a single unit "can't" makes the negative and only later does he learn that there are two, not one, units involved in the utterance. This would be a case of response integration which is inappropriate

and, subsequently, the child will have to learn to break the integrated unit into its component parts.

Once the auxiliary negative unit has been recognized as an important feature, or functional stimulus, in the class of negative utterances, it will be used as such. Once again, there are situations in which the child will be correct in his constructions and occasions in which he will not be correct. For example, "No, I can't see you." and "Don't leave me." are grammatically correct utterances, while "I don't sit on Jack coffee." and "Why not cracker can't talk? communicate but they are not grammatically correct. In the sentence beginning "I don't sit..." the child has not acquired the complicated special case, "I am not sitting..." and has overgeneralized from the classes of lexical items he has available to him. In the case, "Why not cracker can't talk?" he has taken a grammatically correct question form, "Why not?" and put it together with a grammatically correct negative-declarative "cracker can't talk" and formed a grammatically incorrect double negative question. While redundancy is clearly a part of the language, this particular case is not acceptable in the criterion language. Thus, we find in the next stage of the child's acquisition of the negative question form that the redundant "not" drops out of the sequence and we get the more grammatically correct "Why cracker can't talk?" He still must learn, of course, the inversion of auxiliary and noun phrase to make this completely correct in terms of the criterion language, ignoring the missing article.

The third phase of the development of the negative appears to be primarily a function of learning which is not specific to the negative. He is now learning intonation contours for sentences and these are

applied to negatives as well as other sentence forms. He has now separated the auxiliary from the negative so that he might be predicted to begin to say "can not" now when he only said "can't" prior to this. Indefinite determiners are coming into his language as lexical items and are used in negative sentences as well as in simple declarative sentences. He must learn that with the negative form sentence there are special rules which apply to this class of words, i.e., this is a case of breaking down a response equivalence class which has been overgeneralized so that under the conditions of the negative case another equivalence or subclass equivalence is correct.

The rapidity with which all of these linguistic events, we have been discussing, occur has been noted as surprising. I do not agree that it is unusually rapid learning, for I think we frequently underestimate the learning capabilities of a child who is interested in learning. In addition to the high level of motivation, there is a great amount of linguistic stimulation on all sides of the child especially since the advent of TV. Finally, there is a tremendous amount of practice every day in the child's life. I am not particularly impressed that learning of language grammar is achieved in a matter of 3 or 4 years.

I have not attempted to analyze each individual instance which has been presented, but I will leave the data at this point and attempt to summarize. We are faced with an array of utterances made by a group of children. Distributional analyses of the arrays of each child show that there are regularities in those data. As with any other array of data in which there are consistencies there

are also inconsistencies. We need to account for them all, but our task here has been to see what we can do with the consistencies first and hope that as we do so the apparent inconsistencies will either be revealed as consistent with the theoretical analysis once constructed, or, require modification in the theory.

The theory which I have attempted to apply here is one developed to account for the learning of a variety of behaviors exhibited by the human organism. The emphasis has been upon the concepts of mediation, with particular attention to the development of sequences through chaining and classes through equivalences when consideration is given to the characteristics of the stimulus complex presented to the child and the aspects of that complex which may act as the functional stimuli for him. I have assumed that language learning is not basically different from any other kind of learning except in the complexity of the stimuli presented and responses to be learned. There is little question that the theory is incomplete in its ability to handle the phenomena associated with paired-assoicate learning for which it was devised. That the theory will not account for all of the data which we are considering here is not surprising, but the fact that it does account for as much as I believe it does is more surprising. But whether the theory adequately handles the data or not is less important, at this point, than the stimulus value it may have for experimental research with both natural language and artificially developed languages. It is in such research that we will find the answers and the basis for reducing the speculative nature of our accounts of how a child learns to talk.

One final point may be relevant. Both the linguist and the

psychologist are concerned with the problems of language to which we are directing our attention, but the two disciplines do not have the same goals in mind. A failure to recognize the difference in the directions of the two efforts may lead to confusions which are unnecessary and irrelevant to the goals of either. The linguist, at least the linguist of the generative grammar group, has set as his goal the formulation of a set of rules which will allow the generation, or prediction, of all possible grammatically correct utterances which a native speaker of a language might conceive but no utterances which would be considered grammatically incorrect by a native speaker of the language. Thus, analysis of the language is the primary goal of the linguist with the specified behavior of the native speaker as a check upon the adequacy of the linguistic analysis. From the psychologist's point of view, this is an acceptable, though limited, behavioral problem in which the characteristics of a language are analyzed for the purposes of predicting responses of grammatical acceptance of language utterances by a particular population of people.

The psychologist, however, is interested in developing a theory to account for the verbal behavior, among other behaviors, of organisms regardless of the grammaticality of the verbal behavior. The explanation and prediction of all behavior is the primary goal of the psychologist. The grammatical characteristics of the language are of secondary importance in the sense that they may be used primarily as a guide to understanding aspects of the structure of the behavior being observed. The structure which the linguist attributes to the language for the purposes which he has in mind may

or may not have any direct bearing on what the organism is doing either when he acquires the language or after having acquired the language, when he utters a statement which may or may not be grammatically correct.

We are attempting here to account for how the child learns to talk. We have been helped considerably in understanding the problem by the linguistic analyses of the rules of the grammar but those rules do not necessarily help us to understand the variables which account for the behavior exhibited by the child. They are rules about language. The rules about behavior may be of quite different sorts.

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ADDITIONAL FOOTNOTES TO THE ORIGINAL MANUSCRIPT

Footnote 3, Page 11, Paragraph 2, after the word intelligibility.

Thus, the child learns that when he says, "that flower" it is sometimes misinterpreted but "that a blue flower" is more frequently responded to appropriately and when additional syntactic details are added communication is more efficient. The child is not necessarily told (given verbal pellets) that a particular utterance is correct or incorrect. He discovers the syntactic details which allow more precise communication by attaining his desires more frequently and rapidly as he meets more of the criterial requirements.

Footnote 4, Page 13, at the end of Paragraph 1.

It should be pointed out in this context that the theory has little to say about order in the stimulus equivalence and response equivalence paradigms. There is no basis for predicting that "want ball" is any more likely than "ball want" or that "allgone milk" is more likely than "milk allgone." It would be necessary to postulate that the most frequent order apparent in parental utterances such as, "Do you want the ball?" or "The milk is all gone." would increase the probability of "want ball" and "milk allgone." While this hypothesis for the determinant of word order seems to fit this author's best guesses about the frequency of word order in parental utterances and the word order in most of the available examples of childrens P-O and O-P constructions, it does not fit the constructions which Braine (1963) reports for Gregory who used "allgone" as a pivot word in the first position.

Footnote 5, Again on page 13, Paragraph 2, four lines from the bottom after the word utterances.

Since this paper was written, Braine (in press) has also argued that the open-open construction is a later development and represents a more complicated structure than the P-O and O-P construction.

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Footnote 6, Page 15, Paragraph 2, line 12, after the word manner.

For example, if "man car" and "other car" are utterances of the child, then "man" and "other" acquire stimulus equivalence making them capable of eliciting each other as well as eliciting "car" and the construction "man other car" is possible. As noted earlier, however, such an explanation alone does not account for the problem of order and, thus, must predict that "other man car" is as equally likely as "man other car," other things equal.

Footnote 7, Page 17, Paragraph 1, next to the last line after the word correction.

Brown (in press) reports that parents are not particularly inclined to correct the grammatical errors of the child but rather they are more likely to focus upon the truth value of the child's utterances.

Footnote 8, Page 18, Paragraph 1, after the last word corrected.

See the Addendum to this chapter for the report of an experimental analogy to this natural observation about the development of inflections (Palermo and Eberhart, in press).

Footnote 9, Again on Page 18 at the end of Paragraph 2, after the word available.

Perhaps the permissive child rearing practices which are currently in vogue have reduced the frequency of "No" as an utterance directed toward children by parents. It might be of interest to determine whether different child rearing practices might influence the use of this word by children and the development of negative transformations in general.

Addendum

If it is assumed that the position presented by the transformational grammarians represents a new paradigm for psychology, in the sense in which Kuhn (1962) has used the term paradigm in connection with scientific revolutions, then there is little point in persuasive discussion which attempts to argue logically from the orientation of one or another paradigm. Two different paradigms have two different theoretical orientations, two different notions of what are relevant problems for investigation, two different methods of obtaining answers and there is no continuation from one to the other. Shifting paradigms is, in Kuhn's opinion, a discontinuous process which is afactual in nature and based more upon the promise of the new paradigm for problems poorly handled by the old than upon the adequacy of the new paradigm for all problems of interest. Thus, to argue the adequacies of one paradigm to a person operating within the other paradigm is to present a logical arguement which is irrelevant.

Despite this view of the history of science, there appears in the chapters presented here a continuum from a staunch "new" paradigm position represented by McNeill through an intermediate position represented by Schlesinger to an equally vigorous stand in support of the "old" paradigm by Staats. In addition, there appears to be a dimension, which for lack of a better description, seems to relate to the stress placed upon the first two as opposed to the last three syllables in the word psycholinguistic. While it is not necessary for the two dimensions to be correlated, it would appear that McNeill focuses more upon the linguistic while Staats focuses primarily upon the psychological and, again, Schlesinger is in an intermediate position. While the present author was asked to represent an extreme position in the original symposium out of which this book grew, I would like to conceive of myself in an intermediary position on both dimensions:closer, perhaps, than Schlesinger to Staats on the psychology dimension but congruent with Schlesinger with respect to paradigm.

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I would like to examine some of the problems associated with the two anchor positions of McNeill and Staats recognizing that in so doing I may speak irrelevancies to both from the orientation toward scientific history taken by Kuhn.

It seems to me that the form of the analysis of language presented by Chomsky and his colleagues (e.g., Chomsky, 1957, 1965; Halle, 1964; Katz and Fodor, 1963) is clearly a great contribution to psychology as well as to linguistics. It has provided psychologists with a handle on the problem of language long pushed to one side for reasons which are historical to psychology as well as to reasons related to the adequacies of previous linguistic analyses for psychology. The problem is to establish how a theory developed in the field of linguistics is relevant to the field of psychology. To reiterate the last point made in my previous comments, linguistic theory is developed to satisfy the criteria of the science of linguistics and not those of psychology. The goals of the two disciplines are not the same and there is no reason to assume that a theory devised for one should be adequate for the other. Thus, it is very surprising, for example, that McNeill should be concerned that the order of emergence of indeterminate pronouns in the child's language acquisition is not the same as the order of derivation of indeterminate pronouns in the grammer of English. There is no reason why the linguist's analysis of language should correlate with the child's acquisition of language. Such assumptions confuse linguistic theory with psychological phenomena. McNeill seems to make this kind of error in another context when he states that "...the hierarchical arrangement of speech is inherent in the ability of children to comprehend and express meaning...". To say that sentences are hierarchical is to say that one way of analyzing them linguistically is hierarchically, but that may not be the way the organism operates. The three word utterances of children are hierarchical because that is the way we analyze them for linguistic purposes but not necessarily because that is the way the child organizes his behavior. There is no counter evidence at this point to the notion

Staats advances that these are merely strings of three words. Two theories lead to two ways of conceptualization and data alone will give the answers as to which conceptualization is most fruitful. It might be pointed out here that McNeill's syntactic features analyses of the development of the pivot-open constructions apparent in the initial utterances of children is amazingly reminicent of my own discussion in terms of mediation, as well as Braine's theory of contextual generalization (1963). The terminology varies as do some of the derivations but the theory seems little different stripped of the surface elements. In any case, McNeill seems to have accepted a new paradigm and his confidence in the theory leads to occasional over statements (As in the case of indicating that syntax is complete by age four when Menyuk's data (1963) suggest that even in the first grade at least syntactic performance, if not competence, is still unstable.) and the occasional confusion of fact with theory in the absence of data. While aspects of the theory have a great deal of appeal, little is to be gained by attempting to establish its usefulness in this manner. It is experimental research on which the theory will be honed.

On the other hand, at the other extreme, Staats does not seem to come to grips with the complexities of language. He seems to accept the Markov chain model of sentence formation without responding to the strong argument which Chomsky (1957) has forcefully presented against such a model. The arguments for some higher order organization of language behavior, even if only at the level of rules [less easily conceptualized in S-R terms, see Jenkins & Palermo's analysis of the Esper experiments (1964)], is rather convincing. In general, the eleven aspects of language presented by Staats are of concern but they do not deal with acquisition nor some of the other problems (e.g., ambiguities of semantics and syntax and equivalent meanings of active and passive sentences) which must be faced by psychologists. Further, Staats' examples of how learning theory can handle various observations of child language do not seem entirely convincing.

His analysis of "Bread please" is reasonable within a learning framework but does not appear equally convincing when examples of actual child utterances are considered. Thus, there is little similarity in his description of the acquisition of this phrase and the utterance "Allgone outside". The theoretical learning analysis necessary to get from parental speech to the child's speech, as Staats presents it, is formidable. The complexity of the problem must be admitted before the principles of learning which may be involved can be developed and applied. His treatment of the negative sentence appears to be another case of over simplification and convenient ignoring of some of the data, e.g., the double and triple negative in the fourth stage of development. Again, the treatment of the learning of concrete words may be reasonable within a learning framework but application of a similar approach to abstract words such as "fun", "right" and "pretend" or the function words does not seem as convincing.

In addition, Staats implies that memory span is merely a function of training and that, in principle, a child could be trained to imitate an infinitely long sentence if the associative bonds from word to word had been trained in. While such an argument could be tested, it seems that Staats is using such arguments because he is unwilling to agree that the concept of maturation (or for that matter genetics and/or biology) are relevant to considerations of language. He does pay tribute to the biology of the organism but continually attempts to provide other kinds of explanations to avoid the biological. It seems inconceivable that genetics could have relevance to height, weight, eye color, resistance to disease and not to behavior. The influences may not be as direct but surely they are there and may be used as a part of a theory of learning without diminishing the effectiveness of the learning theory.

Finally, Staats also over-simplifies the problem of imitation, ignoring some of the linguistically important variables and focusing upon the importance of instructional procedures which parents only occasionally use. It seems

reasonably clear that parents do not spend a great deal of time giving instructions in language in any organized fashion such as "Can you say..." as Staats argues. In fact, the analyses of Brown (in press) suggest that the parent concerns himself more with the truth value of the child's utterances than with the grammatical form which the utterances take. If syntax is learned in the simple manner Staats presents, the child is certainly learning very quickly under adverse learning conditions.

On the other side of the ledger, however, the arguments of a learning psychologist cannot be ignored completely because there are numerous aspects of the data which support a learning interpretation. As Staats points out, there are a variety of learning theories and most are more sophisticated than the Watsonian brand of learning theory which seems too often what the critics have in mind when they attack S-R theory. None of the S-R theories, at the present stage of development, are capable of handling all of the data but some are capable of handling parts of the data. To say that learning has little to do with language acquisition is to ignore the findings that, for example, the syntax of passive sentences is late to be acquired, the acquisition of morphophonemic rules is directly related to the frequency with which the rules appear in the language (Berko, 1958) and additions are made to the lexicon throughout life. In addition, some of the predictions made by Staats from his learning theory can be verified. For example, our data on word associations to the stimulus word "He" support the prediction of Staats that irregular verb responses are more likely and more frequent than regular verbs for children in grades one through four (Palermo & Jenkins, 1966).

Such facts lend support to a learning analysis of language and suggest that to discard learning theory as irrelevant is to 'throw the baby out with the bath'. Arguments which indicate that the child cannot possibly discover rules from parental input merely admit to ignorance of the relationship between parental

language and child language and are not statements of fact. It is certainly not clear what aspects of parental speech are relevant to the child as he attempts to acquire the complexities of the language. It is better to admit ignorance than to push the explanation into an unexplorable pigeon hole and close the door to other possibilities. Certainly there is some relation between input and output but what that relationship is remains to be discovered by any means feasible.

The rejection of S-R learning theory is peculiar in another sense if one includes the concept formation and mediation literature. In the latter case, I refer to the literature demonstrating mediation in the paired-associate learning task rather than that advanced by Osgood to account for meaning. I do not believe the arguments rejecting the mediation account of meaning have any relevance for mediation in the paired-associate task and it is a mistake to reject all mediation literature on the basis of the presumed inadequacies of one form of mediation theory (McNeill, in press). In any case, the rejection of this literature seems to be a rejection of the very kind of experimental evidence relevant to understanding language acquisition. It is this literature which deals with the acquisition of rules and the development of abstract categories and examines the influence of rules and categories on other behaviors. The rules studied in past research may not be directly analogous to language but they certainly could be constructed in a manner which would make them so. The present writer (Palermo and Eberhart, in press) has, for example, used the Esper paradigm (1925) to set up a series of experiments which are analogous to the learning of past tense verb inflection in children. Three experiments were conducted using modifications of the Esper paradigm. Using the study-test procedure, subjects learned 16 paired-associates in which the stimuli were 2-digit numbers and the responses were 2-letter pairs. Each single digit was associated with a letter to form a four by four matrix of 2-digit-2-letter stimulus-response pairs. On the study trials the subjects were presented 12 of the 16 pairs in Experiment I, 12 of the 16 pairs plus 4 irregular

pairs in Experiment II, and 12 of the 16 pairs plus 2 irregular pairs in Experiment III. In each experiment all 16 stimuli were presented on the test trials. The irregular pairs were presented two or three times as often as the regular pairs in the study trials. The results indicated that the omitted pairs were learned quickly after the rules or regularities of the presented pairs were learned, i.e., the rules were generalized to new instances. The irregular pairs were learned more rapidly than the regular pairs, i.e., the more frequently presented irregular forms were learned first and subsequently the pairs involving a regular rule were learned. Finally, when the regularized rule was learned, after performance on the irregular forms was perfect, it was observed that errors appeared on the irregular pairs and the errors consisted of regularizing the irregular forms. Thus, the performance of college students in this task showed exactly the same characteristics observed by Ervin (1964) in the natural language utterances of children in the acquisition of past tense inflection of verbs.

Whether one wishes to label this research as related to S-R theory or not makes little difference. The point is that it is a start in the direction of understanding rule learning in a laboratory situation with all the controls so impossible in the natural language situation from which we have gleaned so many interesting hypotheses which have spawned theories both S-R and otherwise. It is more comfortable for this researcher to think of these results within a learning framework than in a framework which attributes performance in this task to some innate characteristics of the organism based upon deep structures transformed into surface structures. But this is a personal preference which has little to do with the data and their relation to language acquisition.

No one questions the innate structural differences between the human animal and the rest of the phylogenetic continuum. The central concern is more with the relative importance one wishes to place upon the structure of the organism and the experiences of that organism upon the behavior it exhibits. The fact that S-R

theory has had a history of ignoring the genetic and biological character of the organism is no reason for those who would wish to emphasize those aspects of the organism in the explanation of behavior to cast aside the contributions which S-R theory has made and can make to the understanding of language acquisition. It may well be that language is species-specific, as Lenneberg (1967) has so forcefully argued, but that merely eliminates the possibility that other animals may acquire a language and says little about learning of language in the human.

Le me close by empahsizing the point that S-R learning theorists of the past have been just as much interested in the mind as any other theoretically orientated psychologist by quoting from an unpublished paper by Spence in which he provided the following definition of psychology: "Psychology is concerned with a certain portion of human experience. From this experience the psychologist constructs what he terms the mind (or covert psychological processes)--a concept or concepts which arise from a peculiar combination of observed facts and the reasoning provoked by their perception."

Footnote: Although not so explicitly, Spence made the same point in a number of other places (Spence, 1956, 1960).

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